

GRNS-GEN IV Meeting
April 3, 2002
Washington, DC

Economic Criteria: Version 3

Gen IV Economic Crosscut Group (ECG)

Observations on Consistency:

- For many economic criteria, there was little explanation of most likely values or ranges
- **Capital-at-Risk and Profitability, which are functions of other criteria (+ independent variables), were not consistently calculated**
- There was a feeling that weighted sums of independent and dependent criteria would lead to an overemphasis of some economic aspects and an underemphasis of others

Solution:

- **Achieve consistent scoring by the TWG Co-Chairs of the independent criteria: (22) Overnight Construction Cost, (23) Production Cost, and (24) Construction Duration**
- **Achieve consensus among the TWG Co-Chairs on the independent variables: (1) Capacity Factor, 90%, (2) Capital Additions, \$2/MWh, and (3) Common Costs, \$150M**
- **Internalize calculation of Criteria (25) Capital-at-Risk and (26) Average Cost (new name) into the evaluation software**

Tools for Consistent Scoring:

- Achieve consistent scoring of Criterion (22) Overnight Construction Cost with reference to **sample construction cost account**
- Achieve consistent scoring of Criterion (23) Production Cost, primarily a function of staffing, with reference to ORNL calculations of **plant staff per MWe**
- Achieve consistent scoring of Criterion (24) Construction Duration with reference to a **sample project schedule**

Criterion 25: Capital-at-Risk

Capital-at-Risk is

**[Overnight Construction Costs + Interest During Construction] x Plant Size
(+ Common Costs, if applicable)***

- * For concepts with **multiple units**, Capital-at-Risk is equal to Costs of Common Facilities + Capital-at-Risk on the First Unit**

Software calculation requires TWGs to state the size of the units and the size of the plant (adjustments are made to the cost per kWe to account for Common Costs)

Criterion 26: Average Cost

Average Cost in \$/MWh is equal to

Overnight Construction Costs per MWh	[a]
+ Interest During Construction per MWh	[b]
+ Capital Additions per MWh	[c]
+ Decommissioning Costs per MWh	[d]
+ Production Costs per MWh	[e]

It is **calculated by the software** using

- ♣ criteria 22, 23 and 24 given by TWGs; and**
- ♣ common assumptions agreed upon in Houston.**

Weighting the Criteria: EC1

- **EC1 (“Life-Cycle Cost Advantage”) under Version 2 included (22) Overnight Construction Costs, (23) Production Costs, and (26) Profitability, hence changed to Average Cost**
- **Given that Average Cost (Criterion 26) is highly correlated with Criteria 22 and 23 and because Average Cost directly addresses the goal of EC1, the ECG suggested to the EMG to place 100% of the weight in EC1 on Criterion 26**

Weighting the Criteria: EC2

- **EC2 (“Comparable Financial Risk”) under Version 2 included Criteria (24) Construction Duration and (25) Capital-at-Risk**
- **Given that Capital-at-Risk is highly correlated with Construction Duration and because Capital-at-Risk directly addresses the goal of EC2, the ECG suggested to the EMG to place 100% of the weight in EC2 on Criterion 25**

Weighting the Criteria: EC1 vs EC2

Two approaches:

- (1) Equal weighting (50%/50%) to be consistent with earlier assumption**
- (2) Twice as much weight on EC1 as on EC2 (67%/33%) to reflect the importance of the potential to generate profit**

The former approach elevates technologies with smaller, but more expensive, units in the overall economic ranking

(current results are based on the approach #1)

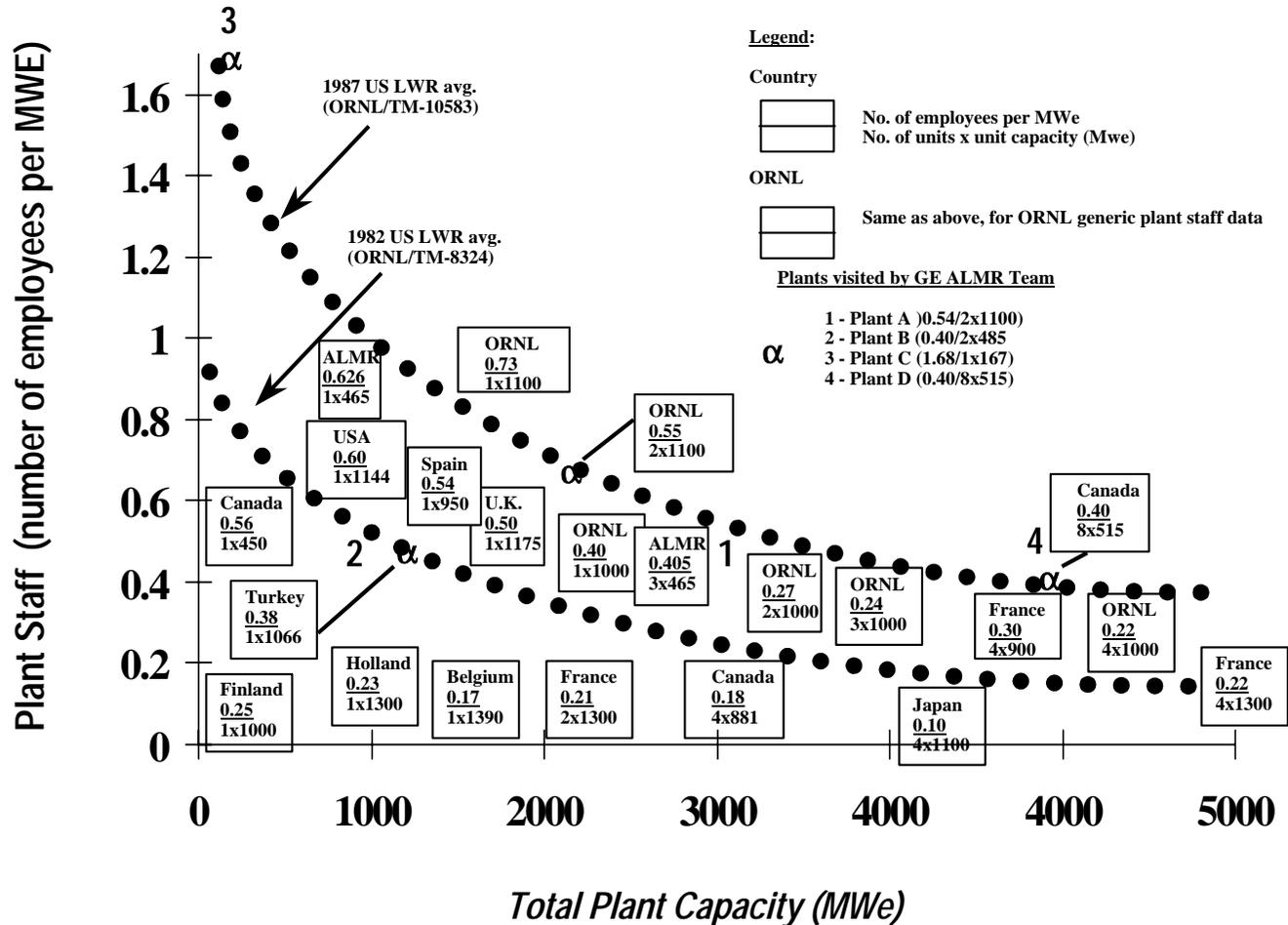
Generic Guidance - Criterion 22

Average Capital Cost of Next Two ABWR Units (built in USA)

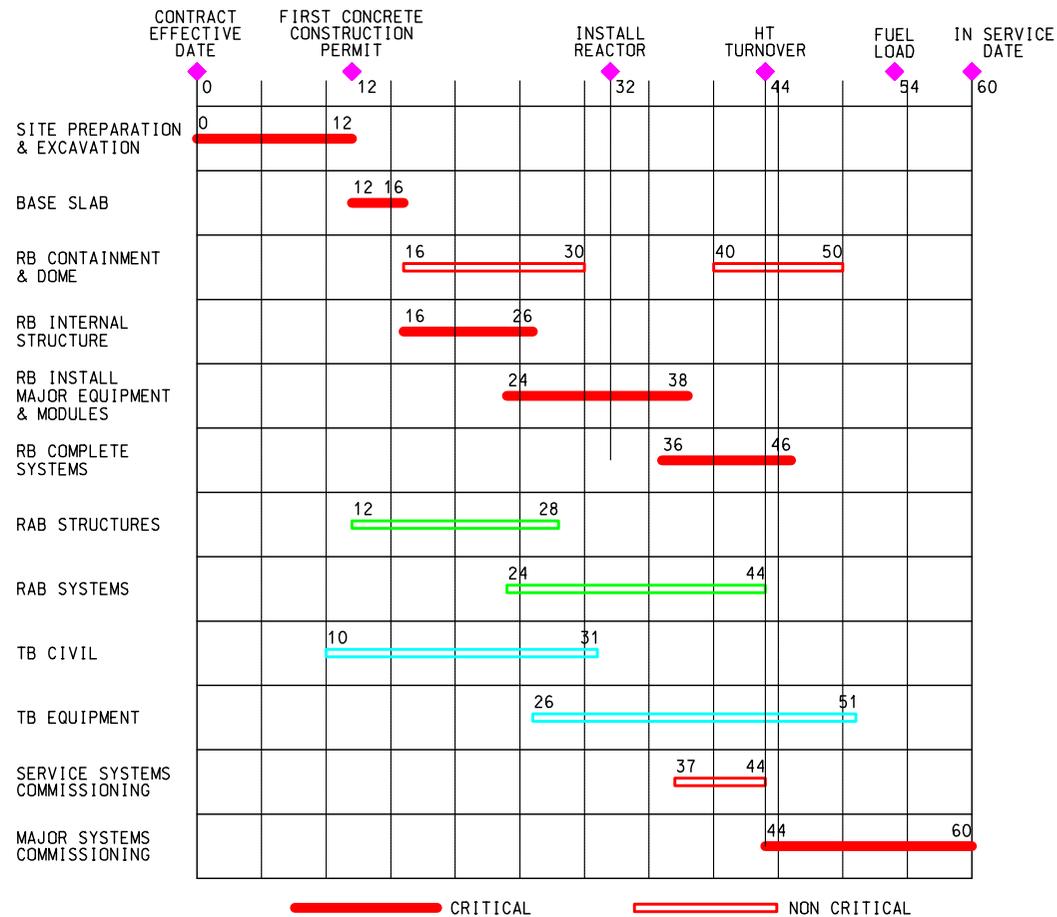
Direct Cost Accounts	millions of US\$
21 Structures and improvements	430
22 Reactor Plant	520
23 Turbine Plant	230
24 Electrical Plant	150
25 Miscellaneous Plant	45
26 Main Heat Rejection System	45
Total Direct Costs	1,420
Indirect Cost Accounts	
91 Construction Services	250
92 Engineering Home Office	70
93 Field Office Services	190
Total Indirect Costs	510
Total Overnight Construction Costs	1,930
Total Overnight Construction Costs/kWe	~ \$ 1,400
Contingency	125
Owner's Cost	200
Total Capital Cost	2,255
Total Capital Cost in US\$/kWe	~ \$ 1,600

NEA. 2000. *Reduction of Capital Costs of Nuclear Power Plants (Paris: OECD) p. 99.*

Generic Guidance - Criterion 23



Generic Guidance - Criterion 24



Example of Project Schedule

Criterion 26 - Calculation [1]

Capital Cost, i.e., [a] + [b], is calculated as

$$\frac{[(\text{Overnight Construction Costs} + \text{IDC}) \times \text{CRF}]}{(\text{CF} \times 8760)}$$

CRF = Capital Recovery Factor = 10.2% (@10% discount rate)

**IDC = Overnight Construction Cost x
(10% x Construction Duration x 0.5)**

CF = Capacity Factor (80% in Version 2, 90% in Version 3)

Criterion 26 - Calculation [2]

Capital Additions [c]

Consensus value is \$2/MWh

Decommissioning Costs [d] are estimated as:

$[1/3 \times \text{Overnight Construction Costs}] \times [0.05/(1.05^{40} - 1)] / [90\% \times 8760]$

Production Costs [e]

Criterion 23